IN THE UNITED STATES PATENT AND TRADEMARK OFFICE BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

In re Application of: **Pomeranz**	§	Attorney Docket No.: **20030016**
Serial No.: **10 / 533,321**	§	Confirmation No.: **5294**
Filed: **May 2, 2005**	§	Examiner: **Carter, Michael W.**
For: **Thulium Pumped Laser Mid-IR Source**	§	Art Unit: **2828**

APPEAL BRIEF

MS Appeal Brief-Patents
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 223 13-1450

Sir:

The present Appeal Brief is submitted in support of the Appeal in the above-identified application.

Please charge BAE Deposit Account **19-0130** in the amount of **$540.00** for the submission of the present Brief. No additional fee or extension of time is believed to be required; however, in the event an additional fee or extension of time is required, please charge that fee to the BAE Deposit Account No. **19-0130.**

TABLE OF CONTENTS

REAL PARTY IN INTEREST

The present application is assigned to BAE Systems, the real party of interest.

RELATED APPEALS AND INTERFERENCES

No related appeal is presently pending.

STATUS OF THE CLAIMS

Claims 1, 2, 4, 5, 9 – 11, 13 and 15 - 24, were finally rejected by the Examiner as noted in the Final Office Action dated January 6, 2009. The rejection of claims 1, 2, 4, 5, 9, 13 and 19 through 23 are being appealed.

STATUS OF AMENDMENTS

A first Response was submitted on December 13, 2007 in reply to a first non-final Office Action dated June 13, 2007. A second Response was submitted on September 18, 2008 in response to a second non-Final Office Action dated March 19, 2008. In response to a Final Office action received dated January 6, 2009 a telephone interview was had with the Examiner that is covered in a Summary of the Examiner dated March 11, 2009. A Notice of Appeal was filed on March 27, 2009.

SUMMARY OF THE CLAIMED SUBJECT MATTER

Independent claim 1 recites a method for pumping an optical parametric oscillator (OPO) 30 (Fig. 1) utilizing two ZGP crystals 40,42 (Fig. 4) that are pumped at 2 microns by a Thulium laser 15 (Page 4, l. 14,15 – Summary)(Fig. 1) and each crystal 40,42 "generates a signal beam

and an idler beam that are all part of the output" from the OPO 30. (Page 10, l. 16,17 & l. 23-25) This is a total of four separate outputs. (Page 10, l. 23-25 – 3.5, 4.6, 3.9 and 4.1 microns)

Independent claim 5 recites a method for pumping an optical parametric oscillator (OPO) 30 without using Holmium (Page 4, l. 10, 16)(Page 7, l. 21), the OPO utilizes two ZGP crystals 40, 42 (Fig. 4)(Page 10, l. 23) that are pumped at 2 microns by a Thulium laser 15 (Page 4, l. 14,15 – Summary), where each crystal 40,42 "generates a signal beam and an idler beam that are all part of the output" from the OPO 30. (Page 10, l.16,17 & l.23-25)

Independent claim 9 recites apparatus for generating infrared radiation comprising a 2 micron Thulium laser 15 (Page 4, l. 14,15 & Summary)(Fig. 1) driving an optical-parametric oscillator (OPO) 30 in the form of a ring. (Page 6, l. 8)(Page 10, l. 23)

Independent claim 19 recites apparatus for generating infrared radiation comprising a 2 micron Thulium laser (Page 4, l. 14,15 & Summary)(Fig. 1) driving a double resonant optical parametric oscillator. (Page 9, l. 11, 19)

GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL

I. The Examiner's rejection of claims 1, 2, 4, 5 under 35 USC 103(a) as being unpatentable over Esterowitz et al (US Patent 6,358,243) in view of in view of Esterowitz et al (US Patent 4,965,803) and further in view of Telfair et al. (US PG Pub 2002/0133146)

II. The Examiner's rejection of claim 13 and claim 9 from which claim 13 depends, and claim 23 with claims 19 through 22 from which claim 23 depends, under 35 USC 103(a) as being unpatentable over 6,358,243 (Esterowitz) in view of 4,965,803 (Esterowitz), and Smith (6,647,033), and further in view of Komine (6,215,800).

ARGUMENTS

I. Rejection of claims 1, 2, 4 and 5

The Examiner's 35 U.S.C. 103(a) rejection of claims 1, 2, 4 and 5 is not well founded and should be reversed. Claims 1 and 5 are independent claims and claim 2 and 4 depend from claim 1.

Applicants independent claim 1 recites: "wherein the optical parametric oscillator includes two zinc germanium phosphide non-linear crystals, and wherein each of the crystals generates a signal beam and an idler beam that are all part of the output from the optical parametric oscillator." (underlining emphasis added)

Applicant's independent claim 5 recites: "wherein the optical parametric oscillator includes two zinc germanium phosphide crystals, and wherein each of the crystals generates a signal beam and an idler beam, and wherein each of said crystals generates a signal beam and an idler beam that are all part of an output from the optical parametric oscillator." (underlining emphasis added)

This distinction of the four outputs was added to claims 1 and 5 in the response to the second, non-final Office action. In the response to the second Office action the applicant specifically pointed out this distinction in the amended claims 1 and 5 stating: "The applicant has amended independent claims 1 and 5 to add that the OPO has 'two zinc germanium phosphide non-linear crystals, and wherein each of the crystals generates a signal beam and an idler beam that are all part of the output from the optical parametric oscillator'." This distinction is detailed in the applicant's specification at page 10, lines 23 - 25 where it describes the four outputs in detail.

The Examiner never addressed the distinction of the four outputs in the third and final Office action, but merely stated that: "Applicant's arguments with respect to claims 1, 2, 4, and 5 have been considered but are moot in view of the new ground(s) of rejection necessitated by amendment."

In paragraph 7 of the third Office action the Examiner states that: "The above combination does not teach there are two zinc germanium phosphide non-linear crystals used in the OPO." It is true that the combination of Esterowitz et al. US Patent 6,358,243 and Esterowitz et al.US Patent 4,965,803 do not teach two ZGP crystals in the OPO. The Examiner then cites Telfair et al (US PG Pub 2002/0133146) as teaching for the OPO having "two nonlinear crystals in order to increase conversion and reduce threshold (paragraph 39)." The Examiner states that in paragraph [0039] of Telfair "The idler beam 52 is coupled out of the cavity …"

However, Telfair specifically teaches ONLY one idler beam 52 and one signal beam 54 that are generated and output from the OPO (paragraph [0024]) and it specifically states in paragraph [0026] that the signal beam is dumped by a "beam dump 32". Only the idler beam is used as indicated in paragraphs [0025] and specifically in the claims. Thus, there is only one useful output from the Telfair OPO and that is the idler beam 52 as mentioned in Telfair paragraph [0039]. In that same paragraph [0039] it teaches that the use of two crystals in the OPO is for "single pass pumping", NOT for providing multiple concurrent outputs from an OPO as taught by the applicant. The Examiner NEVER addressed the four outputs that "are all part of the output" recited in applicant's claims 1 and 5.

In addition, the Examiner's combination of prior art (the two Esterowitz and the Telfair citations) changes the principle of operation of the prior art invention in Telfair and Esterowitz. For two examples, but not for all examples, the frequency of operation of one of the nonlinear crystals in Telfair would have to be changed to be different than the other crystal in that reference, and the beam dump 52 would have to be eliminated in order to operate like the applicant's invention and provide concurrent multiple outputs. The applicant respectfully suggests that this would require a substantial reconstruction and redesign of the elements shown in the Telfair reference and also require a change in the basic principle under which the Telfair reference was designed to operate. "If a proposed modification or combination of the prior art would change the principle of operation of the prior art invention being modified, then the teachings of the references are not

sufficient to render the claims prima facie obvious." *In re Ratti*, 270 F.2d 810, 123 USPQ 349 (CCPA 1959)

Further, one of the three required criteria is not met to establish prima facia obviousness. The prior art cited must teach or suggest all the claim limitations. As previously described applicants claims 1 and 5 both claim a limitation that "each of the crystals generates a signal beam and an idler beam that are all part of the output from the optical parametric oscillator" that is not taught or suggested in the Esterowitz or Telfair references, or in any other reference cited by the Examoner. *In re Vaeck*, 947 F.2d 488, 20 USPQ2d 1438 (Fed. Cir. 1991)

Yet further, the mere fact that references can be combined or modified does not render the resultant combination obvious unless the prior art also suggests the desirability of the combination. *In re Mills*, 916 F.2d 680, 16 USPQ2d 1430 (Fed. Cir. 1990). The cited prior art does not suggest the desirability of the combination made by the applicant to provide four concurrent outputs.

Still further, the applicant respectfully contends that there is no apparent reason to combine the elements of the cited patents because there is nothing in the teachings of the cited patents, the effects of demands known in the design community or present in the marketplace, and the background knowledge possessed by a person having ordinary skill in the art that make the applicant's invention obvious or it would have already been tried or suggested in the crowded laser art. Combining the teaching of the Telfair reference with the two Esterowitz et al patents merely reduces the number of output wavelengths from the Esterowitz patents from two outputs (Esterowitz) to one output (Telfair).

Since claims 1 and 5 are believed to be allowable, as described above, then the combination of claims 1, 2 and 4 are also believed to be allowable. "If an independent claim is nonobvious under 35 U.S.C. 103, then any claim depending therefrom is nonobvious." *In re Fine*, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988).

II. Rejection of claims 13 and 23

The Examiner's 35 U.S.C. 103(a) rejection of claims 13 and 23 are not well founded and should be reversed. Claim 13 is dependent from independent claim 9, and claim 23 is dependent from claim 19 through intermediate claims 20 through 22.

Regarding claims 13 and 23, the Examiner rejected these claims under 35 U.S.C. 103(a) "as being unpatentable over '243 (Esterowitz) in view of '803 (Esterowitz), and Smith ('033), and further in view of Komine, US patent 6,215,800 (hereinafter referred to as Komine)". The Examiner admits that the Esterowitz and Smith patents do "not teach including two ZnGeP2 non-linear crystals.", but the Komine patent teaches "two non-linear crystals in an OPO in order to increase interaction length (column 2, line 39-41)." Therefore, the Examiner argues that: "It would have been obvious to one of ordinary skill in the art, at the time the invention was made, to combine two crystals, as taught by Komine, with the OPO of the previous combination in order to increase interaction length."

The two crystals of the OPO in the Komine reference operate differently than the two crystals in the applicant's OPO. At col. 4. l. 1 – 8 in Komine we read:

> "In operation, the first nonlinear optical medium, such as a PPLN crystal, sustains optical parametric oscillation by producing a signal frequency ω_s and an idler frequency ω_i from the pump frequency ω_p. Those frequencies are directed into the second nonlinear optical medium, such as a PPLN crystal, and such PPLN crystal sustains difference-frequency ω_d mixing by producing an additional idler frequency ω_i' and difference-frequency ω_d. A high reflector output mirror is positioned at the output end of the cavity and is adapted to couple the difference-frequency ω_d, the idler frequency ω_i and the additional idler frequency ω_i' external to the cavity, and said high reflector output mirror is further adapted to be totally reflective to the

signal frequency ω_s to fully contain the signal frequency ω_s within the resonator cavity."

In Komine, at col. 4, l. 16 – 26 we further read that:

"The present invention addresses concerns of existing art with respect to the signal frequency ω_s. The leakage of the signal frequency ω_s through an output mirror will reduce the overall power efficiency of the OPO, but in existing art, leakage of the signal frequency ω_s may be necessary to prevent high feedback which would be deleterious to the strength of the idler frequency ω_i and thus, reduce overall efficiency. The present invention fully entraps the signal frequency ω_s within the resonant cavity to increase maximum efficiency, but without causing deleterious feedback of the signal frequency ω_s."

The applicant respectfully suggests that to make the present invention obvious in view of the two Esterowitz, Smith and Komine references would require a substantial reconstruction and redesign of the elements shown in the OPO of the Komine reference and also require a change in the basic principle under which the Komine reference was designed to operate. Particularly, having to utilize a difference frequency mixing (DFM) crystal in the OPO. (col. 1, l. 57, col. 2, l. 17 & 65 etcetera) "If a proposed modification or combination of the prior art would change the principle of operation of the prior art invention being modified, then the teachings of the references are not sufficient to render the claims prima facie obvious." *In re Ratti*, 270 F.2d 810, 123 USPQ 349 (CCPA 1959)

The idler and signal frequencies from both crystals in the Komine OPO are not all output there from as is done in the applicant's invention, although not recited in applicant's claims. Thus, by combining Komine with the two Esterowitz patents and the Smith patent you change the type of outputs from the combination to something that the applicant does not teach or suggest.

Further, the applicant respectfully contends that there is no apparent reason to combine the elements of the four cited references because there is nothing in the teachings of the cited patents, the effects of demands known in the design community or present in the marketplace, and the background knowledge possessed by a person having ordinary skill in the art that make the applicant's invention obvious. The applicant respectfully contends that combining the two Esterowitz, Smith and Komine references is impermissible hindsight because there is no express motivation to combine the references, including the Komine OPO that operates differently than the applicant's OPO (getting a difference wavelength ω_d as described above, and utilizing a difference frequency mixing – DFM - OPO), to try to get what the applicant teaches.

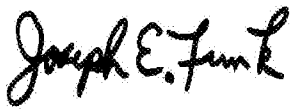
In addition, the applicant respectfully disagrees with the Examiner having to pick four separate patents to attempt to come up with the applicant's invention. Certainly one can pick and choose references (among a great many references in this technical field) each of which shows a part of the method or apparatus of the present invention. That exercise of picking and choosing between references would not, however, serve to predict the beneficial efficiencies obtained by means of the unique combination of steps and elements recited in the claims. A statement of a rejection that includes a large number of rejections must explain with reasonable specificity at least one rejection, otherwise the examiner procedurally fails to establish a *prima facie* case of obviousness. *Ex parte Blanc*, 13 USPQ2d 1383 (Bd. Pat. App. & Inter. 1989). The Examiner has only stated that: "It would have been obvious to one of ordinary skill in the art, at the time the invention was made, to combine two crystals, as taught by Komine, with the OPO of the previous combination in order to increase interaction length." and interaction length is not even claimed by applicant.

Since claims 13 and 23 are respectfully contended to be allowable, as described above, then the combination of claims 9 and 13 (13 depends from 9); and the combination of claims 19 and 23 and the intervening claims (20, 21 and 22) are also believed to be allowable.

CONCLUSION

For the reasons stated above, Appellant believes that the claimed invention is patentably distinct over the cited references, as detailed above. Hence, Appellant respectfully urges the Board to reverse the Examiner's rejections as to claims 1, 2, 4, 5, 9 and 13.

Respectfully submitted,



Joseph E. Funk
Registration No. 25,974
PO Box 661
Londonderry, NH 03053

ATTORNEY FOR APPELLANT

CLAIMS APPENDIX

1. (currently amended) A method of pumping a wide bandwidth optical parametric oscillator to provide mid-IR radiation output, comprising the step of pumping the optical parametric oscillator with a Thulium laser using a laser wavelength of about 2 microns and operating by itself as a pump source for the optical parametric oscillator, wherein the optical parametric oscillator includes two zinc germanium phosphide non-linear crystals, and wherein each of the crystals generates a signal beam and an idler beam that are all part of the output from the optical parametric oscillator.

2. (original) The method of Claim 1, wherein the Thulium laser utilizes a $YAl0_3$ host.

3. (cancelled)

4. (original) The method of Claim 1, wherein the Thulium laser is Q-switched.

5. (currently amended) A method of pumping an optical parametric oscillator without utilizing Holmium, comprising the step of pumping the optical parametric oscillator with a Thulium laser using a laser wavelength of about 2 microns output, wherein the optical parametric oscillator includes two zinc germanium phosphide crystals, and wherein each of the crystals generates a signal beam and an idler beam, and wherein each of said crystals generates a signal beam and an idler beam that are all part of an output from the optical parametric oscillator.

6. (cancelled)
7. (cancelled)
8. (cancelled)

9. (previously amended) Apparatus for generating infrared radiation, comprising the combination of:

a Thulium laser using a laser wavelength of about 2 microns; and,

an optical parametric oscillator pumped by said Thulium laser, wherein said optical-parametric oscillator is in the form of a ring.

10. (original) The apparatus of Claim 9, wherein said Thulium laser is a Tm:$YAlO_3$ laser.

11. (original) The apparatus of Claim 9, wherein said optical parametric oscillator includes a $ZnGeP_2$ non-linear crystal.

12. (cancelled)

13. (previously amended) The apparatus of Claim 9, wherein said optical parametric oscillator includes two $ZnGeP_2$ non-linear crystals.

14. (cancelled)

15. (original) The apparatus of Claim 9, wherein said optical parametric oscillator is doubly resonant.

16. (original) The apparatus of Claim 9, wherein said optical parametric oscillator has a non-linear crystal selected from the group consisting of zinc germanium phosphide, silver gallium selenide, silver gallium indium selenide, gallium arsenide and lithium niobate crystals.

17. (original) The apparatus of Claim 9, wherein said Thulium laser is selected from the group consisting of YAG, YSGG, PALO, LuAG, YU, $Y_2,0_3$ and YVO_4 Thulium lasers.

18. (original) The apparatus of Claim 9, wherein the optical parametric oscillator has a non-linear crystal selected from the group consisting of $ZnGeP_2$, $AgGaSe_2$ AGIS $AgGaS_2$, OPGaAs and PPLN non-linear crystals.

19. (original) Apparatus for generating infrared radiation, comprising the combination of:

a Thulium laser using a laser wavelength of about 2 microns; and,

an optical parametric oscillator pumped by said Thulium laser wherein said optical parametric oscillator is double resonant.

20. (original) The apparatus of Claim 19, wherein said Thulium laser is a Tm:$YAl0_3$ laser.

21. (original) The apparatus of Claim 19, wherein said optical parametric oscillator includes a ZnGeP2 non-linear crystal.

22. (original) The apparatus of Claim 21, wherein said optical parametric oscillator is in the form of a ring.

23. (original) The apparatus of Claim 22, wherein said optical parametric oscillator includes two $ZnGeP_2$ non-linear crystals.

24. (original) The apparatus of Claim 21, wherein said optical parametric oscillator is in the form of a linear resonator.

EVIDENCE APPENDIX

Other than the Office Actions and responses already of record, no additional evidence has been entered by Appellants that is relevant to the present appeal.

RELATED PROCEEDINGS APPENDIX

There is no related proceeding as described by 37 C.F.R. *5* 41.37(c)(l)(x) known to Appellants, Appellants' legal representative or assignee.